EXHIBITS 1-3

REDACTED IN THEIR ENTIRETY

Exhibit 4

High Frequency, High Current Density Voltage Regulators

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Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
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Keywords: voltage regulator module, self-driven, current-tripler, coupling inductors

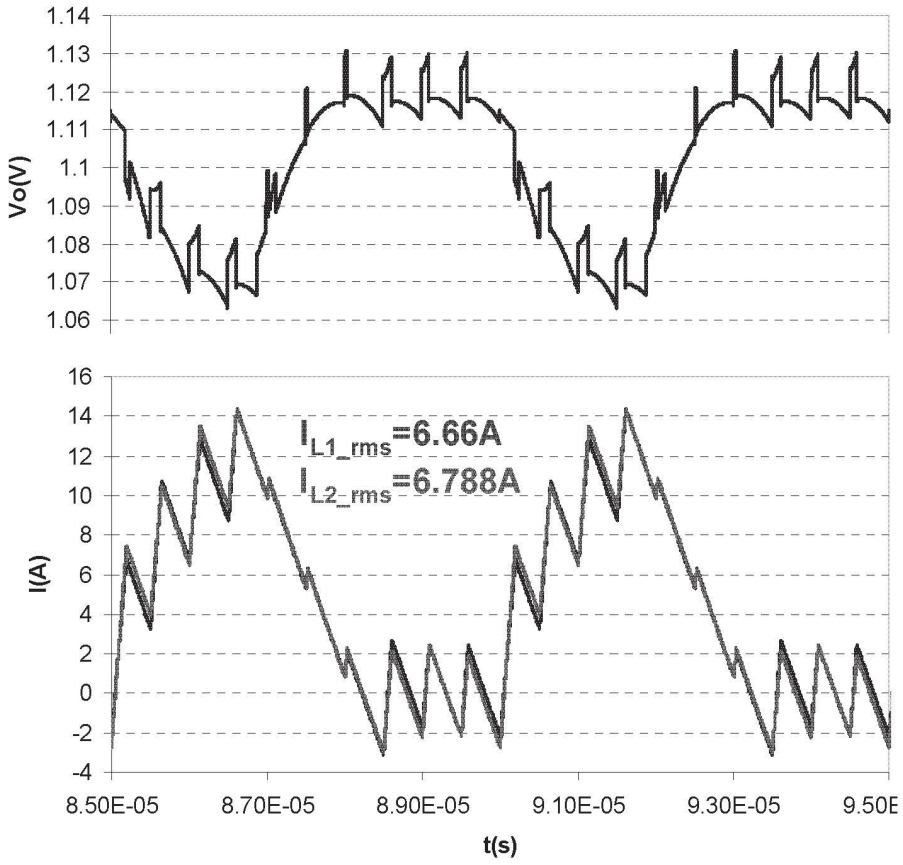

Figure 4.11 Dynamic current sharing

During the transient, the two phases can share the current effectively. Using the same parameters as those listed in Table 4.2, a 25A load step at 100A/us slew rate is applied to the circuit. When the load transient repetitive rate increases, the current sharing is still good, as shown in Figure 4.11, in which the repetitive rate is 200kHz.

Generally speaking, the conventional peak current mode control is capable of sharing the phase current. As long as good current sharing is maintained, the stronger coupling between the inductors will not have any detrimental impact on the circuit, such as severe DC flux imbalance.

4.1.3. Existing Strong Coupling Implementations

Pit-Leong's analysis reveals the benefit of strong coupling. As a special case, the strongest coupling is α=1, which means M=L_s in Figure 4.12a. This can be simply represented by a transformer model, as shown in Figure 4.12b. According to equations (4.2) (4.3) and (4.4), the

three equivalent inductances are all zero. To filter the switching pulse into the output voltage, an additional filter inductor has to be added. The complete coupling inductor circuit is actually implemented by two magnetic components: a well-coupled center-tapped autotransformer and a separate output inductor (Figure 4.13a). The physical structure is shown in Figure 4.13b. The structure is also called a "combining transformer" as in [79]. In the following discussions, this structure is referred as "center-tap coupling inductors".

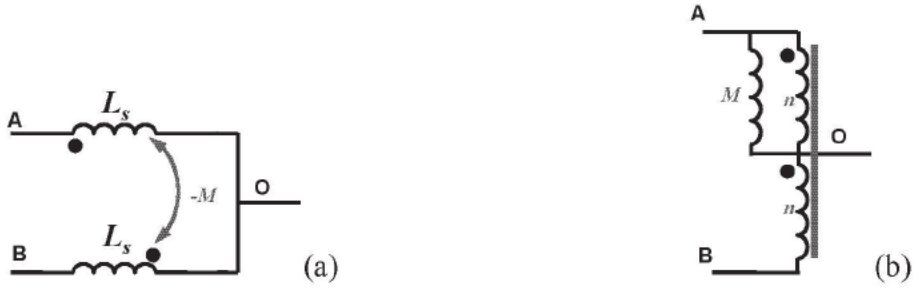

Figure 4.12 Two-winding coupled inductors (a) and the equivalent circuit when L_s=M (b)

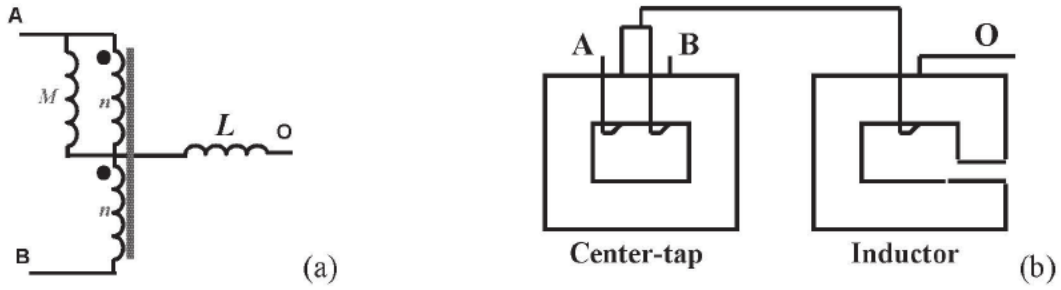

Figure 4.13 Center-tap coupling inductors (a) and the implementations (b)

There is another special case for the coupling inductor shown in Figure 4.1. According to the analysis in section 4.1.2.1, the coupling coefficient approaches one when the outer leg air gaps move to the center leg. Eventually, there will be no outer leg air gap at all. The leakage inductance L_k stays the same during this air gap redistribution. The center leg air gap can be further increased until the entire center leg is removed. Figure 4.14a shows the leakage inductance as a function of the center leg air gap based on the core dimensions in Table 4.1. Meanwhile, the coupling coefficient increases as the center leg becomes shorter and shorter, as illustrated in Figure 4.14b.

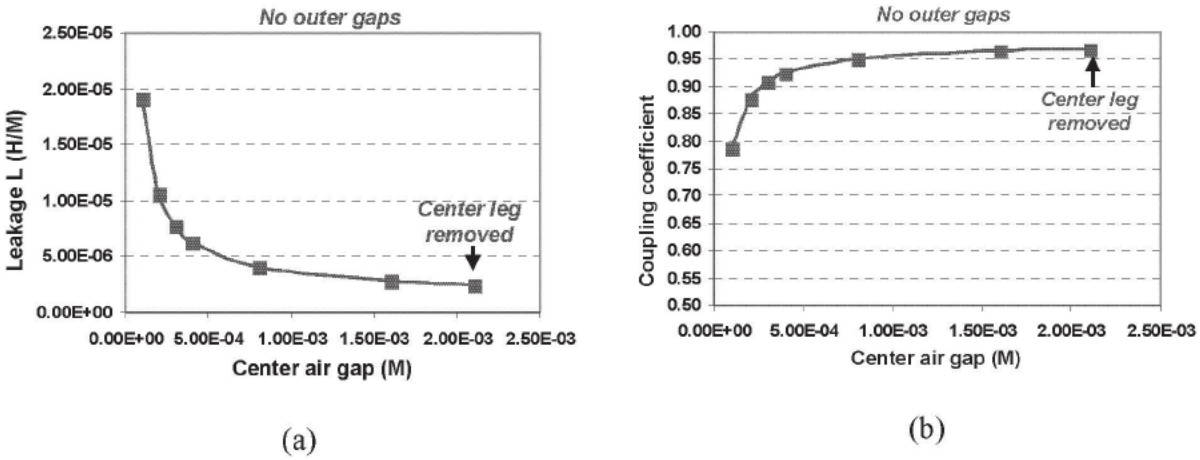

Figure 4.14 Effect of removing the center leg

Based on this understanding, a scalable multi-phase surface mount coupling inductor structure is proposed by [77, 78], as shown in Figure 4.15. For each phase, there is one copper winding around the H-core so that the leg for leakage flux path (center leg in Figure 4.1) is eliminated.

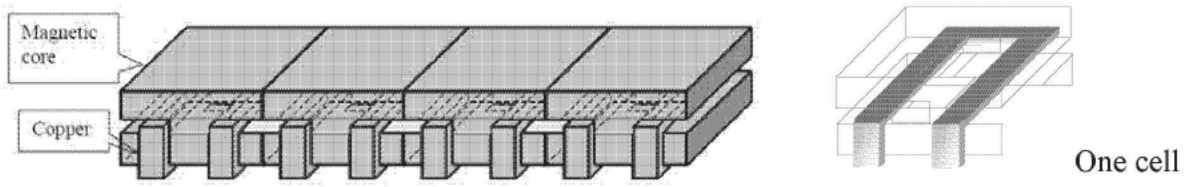

Figure 4.15 A scalable multi-phase surface mount coupling inductor structure proposed by Volterra in [77]

4.2. Proposed Strong Coupling Inductor Structure with Short Winding Length

The coupling inductor structure shown in Figure 4.15 has one disadvantage: in order to make the inverse coupling between phases, the windings must be around the core legs. The winding length is longer than in the non-coupled inductor, and one more copper layer is needed in the layout to connect to the switching node, as illustrated in Figure 4.16.

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Vita

The author, Jinghai Zhou, was born in Zhoushan, Zhejiang, P. R. China in 1973. In 1995, he received a Bachelor of Engineering degree in Electrical Engineering, and in 1998, he received a Master of Engineering degree in Power Electronics, all from Zhejiang University, Hangzhou, China.

In fall 2000, the author joined the Center for Power Electronics Systems (CPES) at Virginia Polytechnic Institute and State University. His research interests include electronic ballast, voltage regulator modules (VRMs), magnetic design and modeling and DC/DC converters.

EXHIBIT 5

REDACTED IN ITS ENTIRETY

Exhibit 6

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

Civil Action No. 19-2240-CFC

VOLTERRA SEMICONDUCTOR LLC,)
)
Plaintiff,)
)
v.)
)
MONOLITHIC POWER SYSTEMS, INC.,)
)
Defendant.)

- - -

HIGHLY CONFIDENTIAL - OUTSIDE ATTORNEYS ONLY

- - -

VIDEOTAPED DEPOSITION OF

JINGHAI ZHOU, Ph.D.

Friday, September 3, 2021

8:59 a.m. PDT

- - -

Reported by:
Lisa A. Knight
Job no: 3097

between.

Q. Okay. So in February 2006, you were Direct- -- sorry, Applications Manager; right?

A. Yes.

Q. And when did you receive your first promotion?

A. I do not remember exactly.

Q. Approximately.

A. 2010 or '9. Yeah.

Q. And what was your new job title after that promotion?

A. The new job title will be Senior Manager.

Q. Senior Applications Manager or just Senior Manager?

A. Senior Manager of Applications.

Q. Approximately when was your next promotion?

A. Approximately 2015-16ish, promoted to a Director.

Q. Is that Director of Applications?

A. Yes.

Q. After your promotion to

Director of Applications, was your next promotion to Senior Director of Cloud Solutions in January of 2019?

A. That is correct.

Q. What were your job responsibilities when you were Director of Applications?

A. As a Director of Applications, I'm managing the Applications team; and also I'm responsible for hiring, build up the team; and also responsible for product definition.

Q. Anything else?

A. That's my main job functions.

Q. Approximately how many people were in the Applications team?

A. Approximately 10 to 15.

Q. Did all 10 to 15 people report directly to you?

A. No. They have managers, and the managers are reporting to me.

Q. And so when you say 10 to 15 people, that includes both the managers and the people that report to those managers?

A. Yes. That's correct.

[redacted]

MR. LAVENUE: Given the nature of the testimony, I'd like to mark the transcript as Highly Confidential, Attorneys' Eyes Only.

BY MR. PIROUZNIA:

Q. How does the history of the digital controller you just mentioned relate to the MP2888A controller?

A. [redacted]

Q. Were you involved in the development of that key architecture?

A. Yes.

Q. What was your role in developing the key architecture of MPS's

digital controller design?

A. Well, as a manager back then, I was mainly reviewing the work that my team was working. And I'm driving the schedules. And also try to -- mostly it's the review work.

Q. Did your review work include reviewing the technical details of the controller architecture?

A. Yes.

Q. Did you provide feedback regarding the technical details of the controller architecture?

A. Counsel, could you repeat your question? I missed one of your words.

Q. Yeah.

Did you provide feedback after you reviewed the technical details of the digital controller architecture?

A. Well, most of those reviews will be done in the meeting -- you know, face-to-face meeting or the online meetings. And most of my feedback would be done in that meeting verbally; just point to the team, you know, what we should do, what is the right

direction we should go.

Q. So you mainly provided verbal feedback regarding the technical details of the digital controller architecture; right?

A. Yes.

Q. Approximately when was the MP2888A controller developed?

A. Again, Counsel, I don't remember exactly, but if -- 2017 -- maybe earlier, 2016-17ish.

Q. What was your role in developing the MP2888A controller?

A. It's very similar, like I was always been doing. You know, I review the architecture, review with the team until, you know -- ask questions and see where we can improve.

Q. Was the MP2888A controller customized for any particular customer?

A. MP2888A was a controller designed according to a specific customer's specification.

Q. And who was that?

A. The customer name NVIDIA.

Q. Did NVIDIA approach MPS to

solutions like the two-stage 48-volt solution you guys presented at APEC 2018?

A. Yes, I do.

Q. Your most recent job title is Vice President of Cloud Computing as of July of 2021; right?

A. That is correct, Counsel.

Q. How did your job responsibilities change when you went from Senior Director of Cloud Solutions to Vice President of Cloud Computing?

A. It was only -- actually only two months into the job. So I'm still trying to get familiar with what my exact -- what I'm, you know, up to.

But I think my expectation for this is I have more responsibility for the business to grow and to make sure, you know, we maintain the right direction of this Cloud Computing group within MPS. And that's, you know, a high level. Yes.

Q. I'm going to drop Exhibit 3 into the Chat now, which is a declaration you submitted earlier in this case. And I'll share my screen with you.

Q. Can you give me an example of a single of the numerous customers you refer to in paragraph 2 that expressed concern and confusion about the breadth of products implicated in this lawsuit?

A. Counsel, could you repeat your question? It's very long question.

Q. Can you give me an example of a single customer of the numerous customers you reference in paragraph 2?

A. Let me read this paragraph again.

(Document[s] reviewed.)

Can you flip to the next page, please?

(Document[s] reviewed.)

Yeah. Now I -- yes, I read through the report. You can go back to the previous page.

Thank you.

Q. I'll repeat my question for you: Can you give me an example of a single customer of the numerous customers you referred to in paragraph 2?

A. [redacted]

[redacted]

[redacted]

[redacted]

And MPS was proposing -- was providing both a coupled inductor solution and a noncoupled inductor solutions.

And because of this -- because of this litigation and what ended up was the [redacted] project was cancelled. And the [redacted] project, they went to the discrete solution altogether.

I think that's an example of this paragraph.

Q. Are there any other exemplary customers you can think of?

A. Not that I recall, Counsel.

Q. Were you personally involved in the pitch to Intel?

A. I was not, Counsel.

Q. Do you know when that pitch to Intel occurred?

A. I do not recall.

Q. Do you know if it was before or after the lawsuit was filed?

A. I do not recall exactly.

for the specific project, it's not my interest. It's none of MPS interest.

So our sole focus is to provide the best semiconductor ICs for our valued customers.

Q. Are you aware of any projects that MPS worked on with its customers that included coupled inductors prior to the NVIDIA 48-volt project?

A. I do not recall.

Q. Does that mean you're not aware of any?

A. Again, I do not recall.

Q. I'm just not sure that's clear in the record.

Can you not recall today or you just don't know one way or the other if any projects existed?

A. Could you repeat your question, Counsel, so I can answer it better?

Q. Never mind. I think the record's clear.

Besides [redacted] and [redacted] are you aware of any third parties that MPS discussed this lawsuit with?

A. I was not.
Q. And you're currently not aware of any?
A. I was not aware of any.
Q. Besides [redacted] and [redacted] are you aware of any third parties that MPS discussed Volterra's patents with?
A. Oh, let me rephrase that, because the [redacted] communication was also -- I remember I was on a CC list, but the gentleman, Ahmed, was also in the copy.
Q. I see.
So you're saying NVIDIA's another third party that you -- that MPS discussed Volterra's patents with?
A. What I'm saying is that in that [redacted] e-mail string, that all the conversations, I was on the CC list, and also that NVIDIA engineer, Ahmed, was on the CC list.
Q. So besides [redacted] and [redacted] are you aware of any third parties that MPS discussed Volterra's patents with?
A. I was not aware of any others.

MR. PIROUZNIA: All right. Mr. Zhou, we've been going a little over an hour. Would you like to take your lunch break right now?

THE DEPONENT: That would be great.

MR. PIROUZNIA: I think we're ready to go off the record.

THE VIDEOGRAPHER: Okay. We're off the record. The time is 12:36 p.m.

(Recess taken.)

THE VIDEOGRAPHER: We're back on the record. The time is 1:43 p.m.

BY MR. PIROUZNIA:

Q. Welcome back, Mr. Zhou.

A. Thank you.

Q. Did you discuss the substance of your testimony during the lunch break?

A. No.

Q. I dropped Exhibit 4 in the Chat. It is MAXIM11320. I'll share my screen with you.

(Zhou Exhibit 4, Jinghai Zhou Dissertation, Bates

MAXIM_00011320 to -517, was marked for identification, as of this date.)

Q. Do you recognize this document?

A. Yes, Counsel.

Q. And what is it?

A. I'm reading the first page of the document. And let me see. Is that a complete document or just one page?

Q. The document is 198 pages. I can flip through it or scroll to the end. Whatever you prefer.

A. Yeah, I would like to quickly go through it to make sure that was the document.

(Document[s] reviewed.)

Q. That's the end of the Table of Contents. Would you like me to scroll down a little more quickly now?

A. Yes, you can do that.

(Document[s] reviewed.)

Thank you.

Q. Do you recognize Exhibit 4, Mr. Zhou?

A. Yes, Counsel.
Q. What is it?
A. This is my Ph.D. dissertation that I wrote 15, 16 years ago.
Q. What was your dissertation about?
A. If I remember correctly -- and I'm reading this title page -- it's about voltage regulators.
Q. Approximately how long did it take for you to research and write your dissertation?
A. Well, that dissertation is a summary of my more-than-four-years' Ph.D. work at Virginia Tech.
Q. When you say it's a summary of the four years of your work, did you begin working on your dissertation when you began the Ph.D. program?
A. Counsel, this is 15, 16 years ago. And I can't be sure, but what -- when exactly I started to write the dissertation, the writing part, but the research work is definitely starting from pretty much Day 1, including the classes I was attending and

also the study -- the literature search of all the works outside in the -- yes.

Q. You mentioned attending classes and researching papers.

Was there any other research that went into your dissertation?

A. As a typical Ph.D. student, the thing people -- we do was to first learn the basic knowledge in the area; and also we have to -- we had to study the work that others are doing. And that's the base.

Q. So you researched work that others were doing, and you also researched the basic knowledge in the area of your dissertation; right?

A. Let me clarify that.

You know, this whole process will pretty much last for the entire Ph.D. program.

So it's not a sequential event; it's ongoing process. We have to actively looking for the other research and also continuously taking a class in that program while we are doing the research for this work.

Q. Approximately how many papers did you have to read to prepare your dissertation?

A. I don't remember that. As much as you need to. As much as you need to do your research. It's many.

Q. Do you think it was more or less than a hundred papers?

A. I think it would be more than a hundred.

Q. More than 200?

A. Yeah, it's definitely possible.

Q. Do you think it was less than 500?

A. I don't recall the number.

Q. How did you find the papers that you had to read?

A. There's publications in the library and also in the CPES -- Center of Power Electronics, Virginia Tech, library, the CPES library, and -- yeah, those are the main sources we will have those documents.

Q. When you read a paper of interest, would you also read the papers that are cited in that document?

A. I can't remember exactly but -- after 15 years, but during my study, when I was doing the research, that I will read those papers.

Q. Would the citations in a research paper ever inform you of additional papers that you might want to also read?

A. Yes.

Q. How did you keep track of all the papers that you read?

A. After 15 years, I don't track all of them. But back then, I -- honestly, I don't remember exactly how I tracked them, but I -- those papers are important to -- back then, when I do the research.

Q. Because those papers were important to your research, is it fair to say that you did keep track of them in some way?

A. I can't speak for now, but I believe that the -- in this dissertation, there should be a list of citations, somewhere -- probably at the back -- very back of the dissertation. So that would be the list.

Q. So starting on page 169, which

is Bates MAXIM_11507, the title says Reference; right?

A. Excuse me, Counsel. Can you zoom in a little bit?

Thank you.

(Document[s] reviewed.)

Q. Are these the references that your dissertation relied on?

A. It appears to be. But that -- again, it's 15 years ago. You're asking me a question that I wrapped that up 15 years ago.

Q. Mr. Zhou, do you see on page 178 where the final reference number 136 is listed?

A. 136. I need to read it. International --

(Document[s] reviewed.)

Yes, I do.

Q. In total, your dissertation contained 136 cited references; right?

A. As I'm reading it, yes.

Q. In order to create this reference list, you had to keep track of those 136 pages -- papers; right?

A. Back then, during my study,

yes.

Q. In the beginning of your dissertation, there was a list of figures. I'll just flip to Roman numeral [sic] x on MAXIM_11329.

Do you see the list of figures?

A. I am.

Q. And the list of figures ends on Roman numeral [sic] xviii; correct?

A. I'm reading it, xviii. Yes.

Q. Is it correct that your dissertation includes hundreds of figures?

A. Counsel, I didn't count, and I have no way to tell how many figures I was including -- that was included in this dissertation.

Q. Well, if we just look at page xv -- 15 -- you see it starts at Figure 4.1 for the 4 figures. Right?

A. Yes, I can see that.

Q. And the last "4" figure is 4.53; right?

A. Yes.

Q. And then similarly for the "3" figures, they got to 3.48; right?

A. That is correct.
Q. And the "2" figures go to 2.57; right?
A. Correct.
Q. So can we agree that your dissertation includes more than a hundred figures?
A. More than a hundred, yes.
Q. At the time you wrote your dissertation, was it common for you to cite figures without investigating where they came from?
A. I don't recall the details, so I have no comment on that.
Q. Your dissertation was important for you to graduate with your Ph.D.; right?
A. The dissertation was part of the program.
Q. The citations in the dissertation were important to the dissertation's accuracy; right?
A. In general, yes.
Q. So considering how important your dissertation was to you at that time, would you have expected to cite figures in

your dissertation that you did not investigate the origin of?

A. Again, Counsel, this is 15 years ago. I really don't remember the exact details when the dissertation was written.

Q. Well, I'm not asking you about the exact details, Mr. Zhou. I just want to know if, sitting here today, you would have expected your younger self to investigate the origin of figures before relying on them in your dissertation.

A. If we turn back the time by 15, 16 years, I would agree with that.

Q. When you included figures from other papers, would you cite to those other papers?

A. Counsel, could you repeat your question?

Q. Yeah.

A. Thank you.

Q. When you included figures in your dissertation from other papers, would you include a citation to the paper that the figure originated from?

A. Again, if I go back 15 years, that's exactly what I will do.

Q. How is your dissertation judged?

A. Counsel, what do you mean by "judged"?

Q. If we go to the first page, I see a list of five individuals on the cover sheet.

Do you see that?

A. Yes, I do.

Q. Who are these -- let me ask you a different question.

Why are these individuals listed on the cover of your Ph.D. dissertation?

A. These five professors are in my Ph.D. committee.

Q. What is the purpose of a Ph.D. committee?

A. If I remember, the Ph.D. committee is to -- is the committee that will review the -- review the dissertation and also the committee that I do the Ph.D. defense, for their approval of the work.

Exhibit 7

UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

VOLTERRA SEMICONDUCTOR, LLC,

Plaintiff, Civ. No.

v. 19-2240-CFC

MONOLITHIC POWER SYSTEMS, INC.,

Defendant.

_____/

** H I G H L Y C O N F I D E N T I A L **

REMOTE VIDEOCONFERENCE DEPOSITION OF

ROHAN SAMSI

October 13, 2021

9:00 a.m. Pacific Time

Reported by:

Anne E. Vosburgh, CSR-6804, RPR, CRR

Job No. 3327

mean by that?

A. I'm not very good with, you know, the detailed stuff. But, yeah, I mean, it was basically -- you know -- I'm not really that -- a magnetics person. I'm more of a, you know, control theory person.

So, you know, my understanding was their first phase was coupled -- every phase was coupled to every other phase, that's how I understood it, right? And in a pretty strong way. That's how I understood it, right?

I wouldn't go into any more detail than that because that ends my knowledge, so...

Q. When you were at Primarion and later Infineon, were you aware of any of Volterra's patents on coupled inductors?

A. No, not -- I mean, we knew that they had some patents but, again, every company I've worked at, you're told don't go looking for patents. It just is trouble. Leave that to the experts.

If you have a bright idea, take it

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over to the patent attorney or, you know, patent counsel, depending on where you're at, and we'll take it from there, right? And if we need help in filing, we'll ask you to describe your invention. And that's it, right?

I never really went looking for trouble, so...

Q. Well, let me ask you a different question. When you were working on projects at Primarion and Infineon for DC-to-DC converters, was your decision on whether or not to use a multi-phase coupled inductor colored by Volterra's patents in any way?

A. No. I don't think the subject even came up.

Q. You were generally aware of the patents, but it wasn't like something that you considered in your day-to-day work?

A. No, no -- yeah. I don't think the subject even came up, right. So...

Q. Do you recall how you generally became aware of the patents?

A. Oh, yeah, I mean, like customers

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were using it.

And then you read articles in EE Times about, you know, like, the inductor makers had like Vitec and Pulse. And the people who were kind of supplying those inductors to end customers would kind of talk about how great it was.

So you would read it in a publication, right, like EE Times or someplace like that, right?

Or customers would tell you, they'd be like, hey, this is really cool, you know. And you'd be like, okay. You know.

Q. Is it fair to say Volterra's coupled inductor patents were generally known in the industry?

A. Yeah. You could say that.

MR. LAVENUE: Objection.

THE WITNESS: Sorry?

MR. LAVENUE: I just made an objection. Go ahead.

THE WITNESS: Oh, I -- okay. I'll -- am I --

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BY MR. PIROUZNIA:

Q. No, you're fine. That's the first time an objection has happened today. But from time to time, Mr. Lavenue will make an objection.

So if you could just pause so we can get his objection on the record, and then he'll make an objection. So it's just to keep a record and for the court reporter.

A. Okay. Could you repeat the question?

Q. I think the record is clear. I didn't have a question after you answered the one, it's just you and Mr. Lavenue kind of spoke at the same time.

A. Oh, I apologize. My bad. Sorry, Lionel.

Q. Actually I don't think they got your answer on the record, so let me repeat my question.

I asked: Is it fair to say Volterra's coupled inductor patents were generally known in the industry?

MR. LAVENUE: And I'll object as

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foundation for that. Thank you.

A. I don't know if they were well-known but, I mean, we -- I kind of knew that they had something.

Now, how did I get that knowledge? I don't remember. I knew that they had something on the coupled inductor. Let's put it that way.

BY MR. PIROUZNIA:

Q. And you mentioned that you knew about that because customers or inductor manufacturers would publicize their work with Volterra, right?

A. Yeah. Yeah.

Q. When you transitioned to working at MPS, did you still consider Volterra or Maxim to be a competitor?

A. No, not really. They kind of declined pretty dramatically. I mean, they were -- if you were to rank competitors, they weren't even on the radar, to be honest with you, right?

You know, and then that, I think, happened before I even moved into MPS, right?

A. Maxim is a pretty broad-based semiconductor company. Volterra was the arm that was competing -- or would have competed with me.

Due to their decline, I don't think, you know, Maxim as an entity really was that relevant, right? So...

Q. And earlier when you talked about hearing about Volterra's coupled inductor patents, what time frame was that in?

A. Oh, that was 2008, 2009. Again, I didn't go out and seek them out. I haven't done any patent search. I -- you know, just people talking about it, hey, they have patents and blah, blah, blah, right?

Q. After 2008 and 2009, did anyone ever speak to you about Volterra's coupled inductor intellectual property?

A. Sporadically it comes up but it's not -- you know, people are aware, right? It's one of those things. People are --

It's like the Google search algorithm, right? Everybody knows Google's got their search algorithm. Coca-Cola has

got its secret recipe. One of those things.

Q. So let's take a step back. When did you first encounter coupled inductors?

A. I would say, again, 2008, 2009, that time frame. Because before that I was not in this particular field, right? So before that there was no -- I had no exposure of, you know --

Yes, there were coupled inductors but they were coupled in a different way. They were for flyback applications and for how -- you know, how -- you know, AC-DC type applications.

So they were wound inductors with a cord and such for -- and I used it, right? Just not for this application.

Q. And so in your mind, how did those older coupled inductors used in different applications differ from the coupled inductors you learned of in 2008/2009?

A. Well, so, you know, coupled inductors have been around for a long time. I mean, if you look at AC-DC, right, you generate a buyer supply from your secondary

document that says here's what addresses your concerns. Right? It was a document authored by one of MPS's counsel, patent counsel, that was shared with -- with [redacted] is my recollection.

Q. And whose idea was it to draft that document?

A. I don't remember that, but that was -- it was -- the document itself was authored by Roland, right? Roland Tso, he was our patent counsel.

Q. And do you recall that [redacted] was referring to one of the Volterra's patents in this email from December 11th?

A. I don't remember but, yeah, he had concerns about Volterra, not specifically which patent, but he had concerns, right.

Q. Did [redacted] bring up Volterra during your phone call or meeting when you discussed this issue?

A. I think he did.

Q. Do you recall in what context he referred to Volterra?

A. He mentioned that there were some

coupled inductor patents, and he didn't want to step on that, right? That's -- I mean, I'm paraphrasing here, but that's what he said.

Q. Was that surprising to you?

A. Not really. I mean, every time the word "coupled inductor," you know, in some ways, you know, in the past 10-plus years, it's been coupled inductor and then the next is, oh, Volterra's got some patents on coupled inductors.

But, I mean, if you looked at it that way, then, you know, Intel's got some processor patents, it doesn't allow everybody else to stop making processors, right? So it kind of goes hand-in-hand in some ways, so...

Just -- a part of it stems from, you know, people like me and our ignorance, right? We don't know exactly what -- what the details are, right? So...

Q. Besides Mr. Tso creating that document, what other actions did MPS take upon receiving this information from [redacted] at [redacted]

A. No, that wasn't the only thing. There were requests from multiple people for whatever reason, right? That, hey, you know, coupled inductors, you know that there are patents from Volterra.

So, you know, we had -- best way was to go to our patent counsel and say, you know, tell us if we're doing something wrong and if we're doing something wrong, we'll stop doing it.

And his assessment was no. And he put out a document which we shared, right, to say, no, there was no concern.

Q. So besides [redacted] reaching out to MPS, there were also other third parties that had reached out to MPS regarding Volterra's coupled inductor patents?

A. I think so. That's my recollection. I don't know.

Q. Do you recall who those third parties were?

A. No. No.

Q. Do you remember -- I'm sorry.

Do you remember [redacted] reaching out

HIGHLY CONFIDENTIAL - R. Samsi

to MPS regarding Volterra's coupled inductor patents?

A. They may have, but I don't explicitly remember them. They may have.

Q. How about [redacted]

A. Again, I don't remember exactly who did or did not. But I do know it was not just one -- it wasn't just [redacted] at [redacted] okay?

Q. As far as the other companies that voiced concerns about Volterra's coupled inductor patents, was that at or around the same time as [redacted] December 2018 email?

MR. LAVENUE: Objection, form and foundation.

A. I don't know if it was around the same time, right? But -- you know, timelines are a little fuzzy in my head but, I mean, there were concerns somewhere in the similar time horizon, right, let's just say, not specifically that time frame.

BY MR. PIROUZNIA:

Q. Were those concerns voiced directly to you or to someone else at MPS?

A. Usually it came through like salespeople. You know, sometimes, you know, it may have been to me as well. I just don't remember, right? It was such a long time ago.

All I remember is there were concerns, and we had to figure out how to address those concerns.

Q. In what context did those concerns come about?

A. I don't know if I understand the question.

Q. You mentioned one example was that salespeople might be have heard of these concerns about Volterra's coupled inductor patents, right?

A. Yeah. They usually hear it from the customer, right. I mean, it's usually -- you know, salespeople -- if anything, they're less technical than even I am, which is -- so, you know, they're not going to go sit and read patents.

Whatever they hear, they're hearing from customers, people they're interacting

with.

Q. Why would the subject of coupled inductors come up in an MPS sales employee's conversations with customers?

A. I think we were proposing some coupled inductor solutions, right? We were proposing some of them.

But, I mean, like I said, you know, coupled inductor is a -- there's plenty of, you know -- I don't think Volterra owns every single coupled inductor.

They didn't invent it, right? Certainly not. I think they -- there was plenty of prior art before that.

I mean, they have certain aspects of it, in my opinion, that they, you know -- that they innovated on, and they have patents on.

And in -- from my point of view, as long as we were not stepping on those patents, you know, whatever they may be, you know, we had every right to use any kind of prior art and, you know, provide solutions to our customers.

Q. So based on your understanding, Volterra's patents cover a certain subset of coupled inductors and their use, and not just coupled inductors at large?

A. That's right. That's right. That's right. I think there was plenty of prior art.

And, like I said, AC-DC, there was coupled inductors used in flybacks well before Volterra was even incorporated, I'm pretty much about that.

Because I've opened up designs from the 1970s and 80s that had, you know, AC-DC coupled inductors. I think there were DC-DC coupled inductors in the 90s, right, well before Volterra even existed.

So, again, it's not something new. It's -- for sure they innovated and that's why they had the patents so... but, again, it depends on what those patents speak to.

Q. And I think you said that when MPS proposed certain coupled inductor solutions to customers, some of those customers responded with concerns about Volterra's

HIGHLY CONFIDENTIAL - R. Samsi

MR. PIROUZNIA: No problem. The question was:

"What do you recall Mr. Tso told you about his report?"

MR. LAVENUE: Okay. I'm going to allow it.

Sorry for the diversion, but I had to think through that privilege issue.

MR. PIROUZNIA: No. No. It's perfectly fine. I appreciate it.

THE WITNESS: Sorry. What was the question?

BY MR. PIROUZNIA:

Q. Rohan, what do you recall Mr. Tso told you about his report on Volterra's coupled inductor patent?

A. He basically said we don't infringe and what -- our solution doesn't infringe. I mean, specifically, I don't know what he -- you know, more than just that, in terms of words. But that was what I came away with, that discussion.

Q. Do you recall whether Mr. Tso's report was concerned about one particular

patent or multiple Volterra coupled inductor patents?

A. I -- he told me he surveyed a bunch. But I don't know what a bunch means, so, you know.

Q. Mr. Tso told you his opinion covered a bunch of different Volterra patents; did I understand that right?

A. Yeah. He said "I studied the whole thing." But I don't know what bunch -- whole thing, what does that even mean, right?

I don't know the extent of his homework, but he felt pretty comfortable saying we don't have a problem with Volterra or any of their patents. And I thought, great, if you feel that way, fantastic.

Q. So your understanding, after discussing Mr. Tso's report with him, was that MPS had no concerns with any of Volterra's coupled inductor patents, right?

A. Yes.

Q. Was that in regards to a specific project, such as this NVIDIA project, or just in general?

A. Well, we had a solution -- again, the details of the solution were shared with Mr. Tso, and he responded based on that solution, right, the details of that solution.

And to see if that solution, right, whatever that innovation, solution, whatever you want to call it, infringed.

And his determination was it didn't infringe any of their patents, right? So...

Q. When you say "that solution," are you referring to this NVIDIA 48-volt solution we've been talking about?

A. I think this was part of that, right? I mean, it was one embodiment of that solution.

It could be -- there were different -- not everybody was doing what NVIDIA was exactly doing or, you know, other customers might be have been doing different versions of it. But, summarily, yeah, more or less it was the same, is my understanding.

Q. So it's your understanding that MPS had a coupled inductor-based solution and

maybe there were different varieties of it for NVIDIA and for other customers?

A. Yeah, something like that. That's probably more accurate, right.

Q. And that coupled inductor-based solution was shared with Mr. Tso who then reviewed Volterra's patents and generated his opinion, right?

A. That's right.

Q. Do you see back on Exhibit 7 where Ahmed said, "I am very concerned now, and I need a quick clarification"?

A. Sure.

Q. Do you recall what Ahmed was concerned about?

A. Again, it was the coupled inductor patents or -- you know, that we might be infringing so... that's my recollection.

Q. Do you recall discussing the patents specifically with Ahmed?

A. No. Like I said, I'm not -- I'm not an expert on patents. I don't discuss, you know, hey, this is the details and -- you know, I --

Same process. You go to your in-house counsel and basically say, hey, here's a concern. Do you have any way of allaying that concern?

And patent counsel would -- the department -- there it was a department, right? So a whole big department. And you would just give it to them and they will work on it and tell you what the answer was.

Q. Did MPS have any specific policy with how you were supposed to treat customers raising patent issues? Or was this just your own personal policy?

A. [redacted]

So I'm happy to give it over to

somebody who is actually getting paid instead of, you know, taking on the trouble so...

Q. Understood.

Do you recall having any other meetings with Ahmed about Volterra's patents other than this one we mentioned in Exhibit 7?

A. No. Again, I may or may not have.

But, again, every one of those meetings would have been just -- you know, think of me like a mailman, right? I'm writing down. I'm basically being the messenger so -- if we did have one. I'm not even sure if we had one, right? I don't remember.

Q. If we go back to Exhibit 6, and we scroll up to the email on January 14th, 2019, from Dawson, which is on MPS10092, do you see where Dawson said, "Hi [redacted] please refer to the attachment for the answer to your question"?

A. Sure.

Q. So Dawson is the one who ended up communicating Mr. Tso's opinion to [redacted]

EXHIBIT 8

REDACTED IN ITS ENTIRETY

Exhibit 9

RESTRICTED – ATTORNEYS' EYES ONLY

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

VOLTERRA SEMICONDUCTOR, LLC, Plaintiff, v. MONOLITHIC POWER SYSTEMS, INC., Defendant.	C.A. No. 19-2240-CFC-SRF

REBUTTAL EXPERT REPORT OF JOSHUA PHINNEY REGARDING U.S. PATENT NO. 6,362,986

[redacted] MPS_DE-00010255. This means that the coupling coefficient is merely [redacted], meaning that the windings are far from being perfectly coupled.

[redacted]

58. [redacted] understood that its [redacted] coupled inductor was outside the scope of any patent owned by Volterra and that the scope of Volterra's patents was limited to coupled inductors that had a ratio of magnetizing inductance (Lm) to leakage inductance (Lk) of greater than three. *See* DAL0000001. The [redacted] coupled inductors had a ratio of magnetizing inductance to leakage inductance of less than three. *See id.* [redacted] told MPS that [redacted] can sell "all coupled inductors to our customers," but coupled inductors "need to be used with Maxim's IC" ***unless*** the coupled inductor has an Lm/Lk ratio of less than three. *Id.* MPS told [redacted] that MPS "use[s] [a] standard coupled inductor" and not the "Volterra/Maxim type." *Id.* And since [redacted] did not require the [redacted] coupled inductors to be used with Maxim's components, [redacted] itself did not consider these coupled inductors to be covered by any Volterra patents. Indeed, MPS employees discussed the subject of Volterra's patents on June 27, 2018, in a face-to-face meeting with employees of [redacted]. Lee Tr. at 163:10-23. After

these discussions, [redacted] (licensees of the '986 patent) decided to move forward and make a coupled inductor in discussions with MPS and NVIDIA.

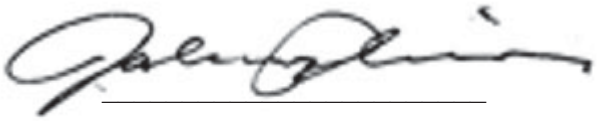
59. [redacted] proposed specifications for the coupled inductor were the result of [redacted] design process. *See id.* at 1288 (MPS employee requesting that [redacted] "Please let [him] know when we can get your updated inductor design."); DAL0001287 (attaching specification proposal and requesting feedback); DAL0001506 ("Please see the [redacted] coupled inductor spec we proposed to MPS for the NVidia 2nd stage power."). MPS provided [redacted] with waveforms and other parameters for the coupled inductor, but it was [redacted], not MPS, who prepared various simulations, figures, and testing results related to the coupled inductor through an iterative process in a presentation dated July 20, 2018. Lee Tr. 193:25-197:12; DAL0000270, DAL0000351. In addition, [redacted] possessed the software to perform the simulations that informed them about whether the coupled inductor could be manufactured with a target efficiency. *Id*.

B. The NVIDIA Power Solution

60. Dr. Dickens provides his opinions on why the NVIDIA Power Solution infringes the Asserted Claims but he fails to analyze the individual components of the power solution. Below, I will provide a detailed description of these components to help explain why MPS does not infringe each of the Asserted Claims.

61. The NVIDIA Power Solution includes an [redacted] resonant converter module for DC-to-DC voltage conversion in its first power stage and a multi-phase DC-to-DC buck converter consisting of an [redacted] controller, [redacted] MOSFET drivers, and [redacted] coupled inductors in its second power stage, as illustrated below. In the following, I will describe each of the components of the NVIDIA Power Solution.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 1, 2021.



Dr. Joshua Phinney

Exhibit 10

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VOLTERRA SEMICONDUCTOR LLC, Plaintiff, v. MONOLITHIC POWER SYSTEMS, INC., Defendant.	C.A. No. 19-2240-CFC

REBUTTAL EXPERT REPORT OF DR. REGAN ZANE ON NONINFRINGEMENT OF U.S. PATENT NOS. 7,525,408 AND 7,772,955

instructed MPS to focus on the coupled inductors. J. Zhou Tr. at 173: 14-18; and D. Huang Tr. at 75:12-18.

72. I further understand from Dr. Zhou's testimony that the reason why NVIDIA wanted to use a coupled inductor instead of a discrete inductor for the NVIDIA Power Solution was partly due to the size requirements of the NVIDIA Power Solution. J. Zhou Tr. at 183:15-21. Specifically, NVIDIA had "very clear dimension requirement[s]" and was "always striving for smaller size." J. Zhou Tr. at 183:22-184:11.

73. I understand that, because MPS does not manufacture or sell any coupled inductors, MPS worked with [redacted]. to design a coupled inductor. DAL0000001. MPS contacted [redacted] in March of 2018, after meeting with Dr. Abou-Alfotouh from NVIDIA, to discuss the use of [redacted] inductors in its proposal for the NVIDIA Power Solution. DAL0000001. As a starting point, I understand that MPS referenced several of [redacted] coupled inductors that had already been designed as potential candidates for testing. DAL0000001. I also understand that, at the onset of any work involving coupled inductors, MPS was clear that it was seeking to "use [a] standard coupled inductor" and not the "Volterra/Maxim type." DAL0000001. I understand that [redacted] told MPS about certain coupled inductors it believed were covered by Volterra's patent. DAL0000001. At the time, [redacted] was aware that its subsidiary, [redacted] had signed a licensing agreement with Volterra in 2009 for Volterra's coupled inductor patents. MAXIM_00007772-7782; Lee Tr. at 37:10-22; 38:17-23; 136: 8-23. [redacted] told MPS that they can sell "all coupled inductors to our customers," but coupled inductors "need to be used with Maxim's IC" unless the coupled inductor has a Lm/Lk ratio of less than three and only two phases. DAL0000001. Both the [redacted] and [redacted] have a Lm/Lk ratio of less than three, and have only two phases. [redacted] had a face-to-face meeting on

June 27, 2018 with MPS employees where the subject of Volterra's patents was discussed, afterwhich [redacted] decided to move forward with the coupled inductor project. DAL0000081.

74. I understand from Dr. Zhou and Mr. Huang's testimonies that based on these brainstorming sessions with NVIDIA, MPS began to pull together a team to provide a proposal for NVIDIA, which consisted of Mr. Huang, Dr. Zhou, and several members from MPS's Hangzhou office. D. Huang Tr. at 151:02-18; MPS_DE-10989 (Email from J. Zhou to Q. Ouyang on May 09, 2018 dividing tasks up for the NVIDIA RFI).

MPS_DE-10989.

75. Mr. Huang's testimony further discloses that MPS began designing the first stage of the proposed solution based on specifications, efficiency requirements, and topology choices from NVIDIA. D. Huang Tr. at 153:16-154:09. NVIDIA further provided a preliminary determination of MPS components which would go into the first-stage of the power module and would then work with MPS to ensure that those components and design choices would fit

431. I declare that all statements made herein of my knowledge are true, that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

I declare under penalty of perjury that the foregoing is true and correct.

Regan Zane

Dated: October 1, 2021

EXHIBIT 11

REDACTED IN ITS ENTIRETY

Exhibit 12

US006362986B1

(12) **United States Patent**
Schultz et al.

(10) **Patent No.: US 6,362,986 B1**
(45) **Date of Patent: Mar. 26, 2002**

(54) **VOLTAGE CONVERTER WITH COUPLED INDUCTIVE WINDINGS, AND ASSOCIATED METHODS**

(75) Inventors: **Aaron M. Schultz**, Sunnyvale, CA (US); **Charles R. Sullivan**, Hanover, NH (US)

(73) Assignee: **Volterra, Inc.**, Fremont, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/814,555**

(22) Filed: **Mar. 22, 2001**

(51) **Int. Cl.**[7] **H02M 7/5387**

(52) **U.S. Cl.** **363/132**

(58) **Field of Search** 363/16, 17, 56.01, 363/56.02, 97, 98, 131, 132

(56) **References Cited**

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OTHER PUBLICATIONS

"A Novel Modeling Concept for Multi–coupling Core Structures", Pit–Leong Wong, Fred C. Lee, Xiaochuan Jia and Daan van Wyk—Document prepared for the Center for Power Electronics Systems, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, Jan. 2001.

"Investigating Coupling Inductors in the Interleaving QSW VRW", Pit–Leong, Qiaoqiao Wu, Peng Xu, Bo Yang and Fred C. Lee, Document prepared for the Center for Power Electronics Systems, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, Mar. 2000.

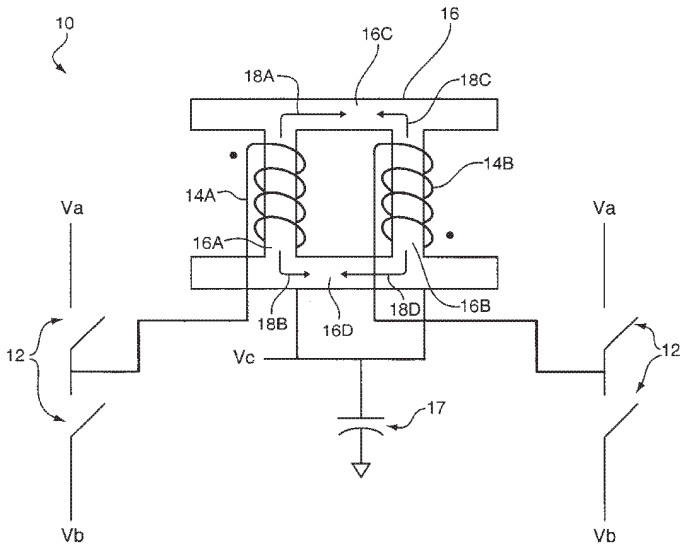
* cited by examiner

Primary Examiner—Matthew Nguyen
(74) *Attorney, Agent, or Firm*—Curtis A. Vock, Esq.; Lathrop & Gage L.C.

(57) **ABSTRACT**

A DC-to-DC converter generates an output voltage from an input voltage. The converter includes first and second inductive windings and a magnetic core. One end of the first winding is switched at about 180 degrees out of phase with one end of the second winding, between ground and the input voltage. The first winding is wound about the core in a first orientation, and the second winding is also wound about the core in the first orientation so as to increase coupling between windings and to reduce ripple current in the windings and other parts of the circuit. This version is a buck converter—versions that form boost, buck-boost and other converters are also provided. The invention also provides a multi-phase DC-to-DC converter for providing an output voltage from an input voltage. The converter has N (N≧2) inductive windings alternatively switched, again in the buck-converter version, between ground and the input voltage. Again, boost, buck-boost, or other versions are also provided. Each of the N windings has a turn-on switching transition separated in switching phase by at least about 360/N degrees from any other of the windings. Each of the windings also has a turn-off switching transition separated in phase by at least about 360/N degrees from any other of the windings. Each of the N windings is wound about the core in like orientation to increase coupling between windings and to reduce ripple current in the windings and other parts of the circuit. The invention also provides suitable core structures.

40 Claims, 16 Drawing Sheets



Having described the invention, we claim:

1. A DC-to-DC converter for providing an output voltage from an input voltage, comprising first and second inductive windings and a magnetic core cooperatively forming a magnetizing inductance, a first voltage across the first winding being switched at about 180 degrees out of phase with a second voltage across the second winding, to regulate magnitude of the output voltage, the first and second voltages being formed from one or a combination of the input and output voltages, each of the first and second windings having a leakage inductance and being coupled to the magnetic core wherein magnetizing inductance is at least three times greater than the leakage inductance of either winding, the first winding being wound about the core in a first orientation, the second winding being wound about the core in the first orientation.

2. A converter according to claim 1, wherein the input voltage comprises first and second input voltages.

3. A converter according to claim 2, wherein the second input voltage comprises ground, wherein the converter operates as a buck converter.

4. A converter according to claim 1, further comprising one or more transistors for switching the windings out of phase wherein a current per time slope during the time intervals in which current is increasing through the windings is approximately defined by the output voltage divided by the leakage inductance subtracted from one half the input voltage divided by the leakage inductance.

5. A converter according to claim 1, wherein the windings and core are constructed and arranged to substantially maximize coupling between windings by maintaining the leakage inductance at a substantially constant level while increasing the magnetizing inductance.

6. A converter according to claim 1, wherein the core comprises first and second substantially parallel core elements, the first winding being wound about the first core element the first orientation, the second winding being wound about the second core element in the first orientation.

7. A converter according to claim 6, further comprising one or more connecting elements rigidly coupling the first and second parallel core elements together.

8. A converter according to claim 1, wherein the core comprises one of a gapped high-permeability element and a low-permeability element, to serve as a leakage path structure to carry at least part of a leakage flux, the leakage flux being defined as a flux present when each of the windings has an equal DC current.

9. A converter according to claim 8, wherein the leakage path structure comprises a core leg or shunt.

10. A converter according to claim 1, further comprising circuitry to activate one or more of the windings at a selected duty cycle.

11. A converter according to claim 10, wherein the duty cycle comprises a duty cycle between about 5% and 90%.

12. A converter according to claim 10, wherein the duty cycle is about 50%.

13. A converter according to claim 1, further comprising circuitry to alternatively activate each of the windings at about 50% duty cycle.

14. A converter according to claim 1, wherein one end of each of the windings is switched between the input voltage and ground.

15. A converter according to claim 1, wherein the first and second windings have an equal number of turns in the windings.

16. A converter according to claim 1, wherein the first winding has a first number of turns and the second winding has a second number of turns, the first number being different from the second number, and wherein a NI product for each of the first and second windings is substantially equal.

17. A method for reducing ripple in a DC-to-DC converter of the type producing an output voltage from an input voltage, comprising the steps of:

orienting, in like direction, first and second windings about a common core to increase coupling between the windings; and

alternatively activating each winding about 180 degrees out of phase with the second winding, to regulate magnitude of the output voltage.

18. A method of claim 17, further comprising switching the voltages across the windings by connecting one end of each winding to a common output voltage, and individually switching the other end of each winding between ground and an input voltage.

19. The method of claim 17, further comprising the step of forming the core with two substantially parallel core elements, wherein the step of orienting comprises orienting each of the windings on a separate core element.

20. The method of claim 17, further comprising the step of activating one or more of the windings at a selected duty cycle.

21. The method of claim 20, wherein the step of activating comprises activating the windings at a duty cycle between about 5% and 90%.

22. The method of claim 20, wherein the step of activating comprises activating the windings at a duty cycle at about 50%.

23. The method of claim 17, further comprising the steps of forming a first number of turns in the first winding and a second number of turns in the second winding.

24. The method of claim 23, wherein the first number is different from the second number, and further comprising the steps of applying a first current through the first winding and applying a second current through the second winding, the first current being different from the second current, wherein a NI product for each of the first and second windings is substantially equal.

25. A DC to DC converter for providing an output voltage from one or more input voltages, comprising (a) a common magnetic core and (b) N inductive windings alternatively switched, at one end, to regulate magnitude of the output voltage, each of the windings having a turn-on switching transition separated in switching phase by at least about 360/N degrees from any other of the windings, each of the windings having a turn-off switching transition separated in phase by at least about 360/N degrees from any other of the windings, each of the N windings being wound about the core in like orientation, N being an integer greater than or equal to three.

26. A converter of claim 25, wherein each of the windings comprises a leakage inductance, each of the windings being coupled the common magnetic core wherein magnetizing inductance defined by magnetic interaction between the windings is greater than about three times the leakage inductance of any one of the windings.

27. A converter according to claim 26, further comprising one or more transistors for switching the windings out of phase wherein a current per time slope during the time intervals in which current is increasing through the windings is approximately defined by the output voltage divided by the leakage inductance subtracted from the input voltage divided by the leakage inductance divided by N.

28. A converter according to claim 26, wherein the windings and core are constructed and arranged to substan-

Exhibit 13

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

Civil Action No. 19-2240-CFC

VOLTERRA SEMICONDUCTOR LLC,

Plaintiff,

v.

MONOLITHIC POWER SYSTEMS, INC.,

Defendant.

- - -

HIGHLY CONFIDENTIAL - ATTORNEYS' EYES ONLY

- - -

VIDEOTAPED DEPOSITION OF

ROLAND TSO

Thursday, September 2, 2021

9:02 a.m. PDT

- - -

Reported by:

Lisa A. Knight

Job no: 3096

a patent with coupled inductors with Jinghai.

Q. How about anyone else at MPS?

A. I can't recall anyone else.

Q. How did Jinghai bring [redacted] e-mail to your attention?

A. He told me about the [redacted] inquiry.

Q. Was that a verbal conversation?

A. I believe that was a verbal conversation.

Q. Do you recall if it was in person?

A. Yes, it was in person.

Q. In your experience at MPS, how often have you received e-mails from vendors identifying patents like [redacted] did here?

A. Can you rephrase?

By, you know, "how often," what do you mean?

Q. I guess, was it a surprise to you that [redacted] raised a potential patent issue?

A. You know, before, I really have never heard of [redacted] Yes, it was a surprise to me about [redacted] bringing up this issue.

Q. Has MPS had other vendors raise patent issues with it during your course of employment at MPS?

A. We receive -- yes, we have received patent -- notices of patents from other parties. Yes.

Q. Did MPS have any policies or procedures it follows when other parties inform it of patents?

A. [redacted]

Q. [redacted]

A. [redacted]

Q. [redacted]

[redacted]?

A. [redacted]

[redacted].

Q. [redacted]

[redacted]

A. [redacted]

[redacted]

[redacted]

[redacted].

Q. Circling back to MPS's policies and procedures. Are those memorialized in any way?

A. [redacted]

[redacted]

Q. You're not aware of --

A. [redacted]

[redacted]

Q. [redacted]

[redacted]

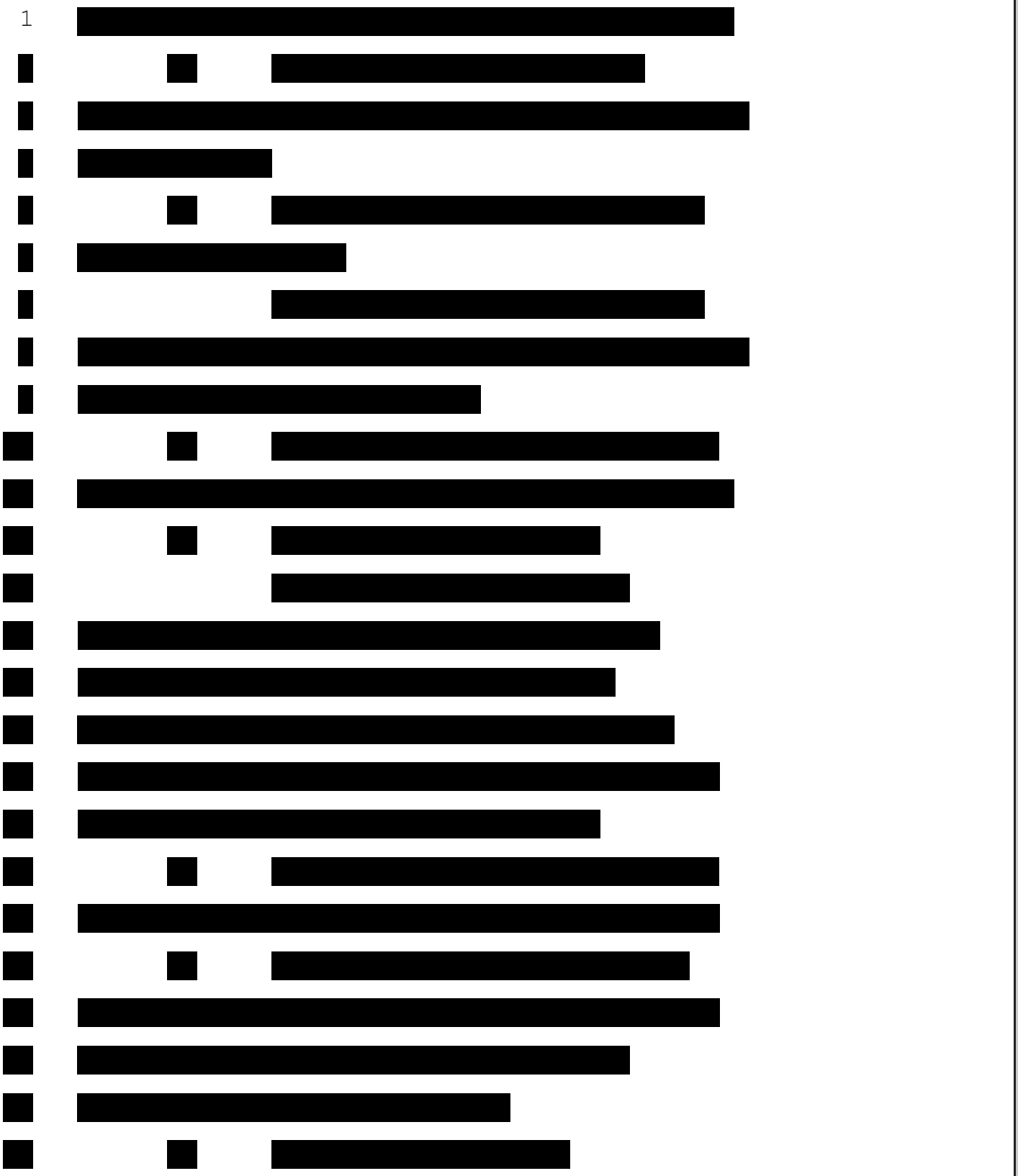
[redacted]

A. [redacted]

[redacted]

[redacted]

[redacted]



[redacted]

Q. When Jinghai approached you about the '986 patent, what did you discuss?

A. When Jinghai approached me, he brought up that [redacted] had brought up the '986, claim 17. And I said, "Yes, I will investigate."

Q. What happened next?

A. I started to investigate -- begun -- initiate the investigation.

Q. What did that investigation involve?

A. The investigation involved

downloading the '986 patent, reviewing it, and also pulling up the '986 file history and reviewing that. And then reviewing claim 17.

And then it also -- you know, that's -- and also, you know, again, to search for relevant prior art, and then to do analysis.

Q. Anything else?

A. Let me see.

Basically, yeah, just to -- I downloaded the patent. I reviewed it and analyzed it and looked at claim 17. Reviewed the file history. Searched for relevant art -- prior art. And I also, you know, read some supplemental articles about coupled inductors to bring me up to speed on coupled inductors.

Q. Now, you mentioned you searched for prior art.

Did you perform that search yourself?

A. Yes, I did.

Q. So you didn't hire any prior art search firms?

A. No, we did not.

Q. Why did you decide to handle this patent analysis yourself, instead of contacting an outside firm?

A. Well, at that time, I had some time to do the investigation. And basically I had the time and felt that I was able to competently do the investigation.

Q. Did you feel that you were qualified to understand the technology in the '986 patent?

A. I felt that I was, you know, a person of ordinary skill in the art to analyze the '986 patent.

Q. Did you feel you were a person of ordinary skill in the art because of your undergraduate degree in electrical engineering?

A. Because of my undergraduate degree in electrical engineering and also my experience gained working in the semiconductor industry and also knowledge gained in reviewing hundreds of patents.

Q. In your experience reviewing hundreds of patents, did you encounter coupled inductors?

A. Prior to the [redacted] notification, I did not review any patents that claimed coupled inductors.

Q. And how did your experience gained working in the semiconductor industry assist you in analyzing the '986 patent?

A. The experience gained in the semiconductor industry provided me with background knowledge on power converters and circuitry and general electronics and how components of electronics operate.

Q. Can you describe for me how you performed the prior art search for the '986 patent?

A. First, I looked at the cited references. And usually I work from that and look up the cited references to see if they apply. And also I would look at the cited references to see what those cited references cite to try to establish some sort of trail in this field. That's what I would do for the -- for cited references.

And then I would do an online search, searching for relevant keywords to see what types of prior art or whatever hits

I can get.

And then once I obtain the list, I would examine each hit or reference to see if it applied or not to claim 17 -- say, for the '986 patent, claim 17.

Q. Is that the procedure you followed for the '986 patent?

A. Yes. Besides also reviewing the file history to see if there were any limitations contained in the file history.

Q. And so when you say you "looked at the cited references," would those be what we see on Exhibit 2, the '986 patent, under number (56), References Cited?

A. Yes.

Q. So we have three patents listed here and a number of publications; right?

A. The publications that are listed in the Other -- the heading Other Publications.

Q. I'm just going to scroll to the second page to see if it's continued there. But, no, it looks like this patent only has a single page of references cited.

And you mentioned that you

performed an online search after looking at the cited references; right?

A. Yes.

Q. What platform did you use for that online search?

A. I used Google.

Q. Google Patents or just Google, generally?

A. Google, generally. And also I used Google Patents.

Q. Any other online platforms?

A. No. For this one, no.

Q. What keywords did you search on Google?

A. On Google, I searched -- the keywords, I put in "coupled inductors" and I also put in "Pit-Leong Wong." And basically, you know, those were the ones, because I see that Pit-Leong Wong in the cited publications; he was listed as the first author in these publications.

Q. Were you familiar with Pit-Leong Wong prior to looking at the '986 patent?

A. No, I was not.

Q. How about Fred C. Lee?
A. Fred C. Lee you're talking about that's listed?
Q. Yes.
A. Fred C. Lee, from what I understand, is a famous professor at Virginia Tech who I heard had built up the power electronics department there.
Q. When did you learn of that knowledge?
A. Well, when I was at Fairchild Semiconductor, we had a conference where -- not conference, but we had a big get-together with the engineers. And Fred C. Lee was invited to speak at that event. And that's when I first saw Fred C. Lee.
Q. Did you meet him at that event?
A. I was in the audience, but I did not personally go up to talk to him.
Q. Have you ever personally spoken with Fred C. Lee?
A. No.
Q. Were you involved in MPS's subpoena to Virginia Tech in this lawsuit?
A. Can you define what

of coupled inductors as used in multiphase buck DC-to-DC converters?

A. Can you repeat that question? It was kind of a long one. I didn't quite catch it.

Q. Yeah.

So you mentioned that you found older articles referencing coupled inductors generally; right?

A. I found older articles referencing coupled inductors utilizing electrical circuits and also in power converters.

Q. Were they utilized in multiphase buck converters?

A. I believe I did find a number of older articles that discuss multiphase buck converters.

Q. That discuss multiphase buck converters on their own and/or coupled inductors?

A. In conjunction -- I believe in conjunction with coupled inductors.

Q. And when you say "older," what do you mean?

A. Well, you know, I believe possibly -- remembering, maybe, five to ten years prior maybe.

Q. And why didn't you rely on those references instead of the three you selected?

A. Well, the three that I selected, I believe, cover every aspect to invalidate claim 17. And I felt that those were the strongest references, so I used those.

Q. Did you ever consider generating a noninfringement opinion with respect to the '986 patent?

A. Well, I had concluded invalidity of claim 17. And also, MPS does not design, produce, nor sell coupled inductors. So since it was invalid, no infringement, there was -- I felt it was not necessary to do such an investigation.

Q. Do you recall telling Dawson Huang that MPS does not infringe the '986 patent?

A. I do not recall any such conversation.

Q. And a moment ago, you mentioned that you concluded the patent was invalid and so there was no infringement. Right?

A. Yes.

Q. Was your conclusion of no infringement based solely on the supposed invalidity of the patent?

A. My conclusion of no infringement because it was concluded that claim 17 was invalid. So since the claim was invalid, there's no infringement.

Q. Did you ever look into the actual coupled inductors that were accused of infringement?

A. Can you repeat that? I'm not sure of what you're asking.

Q. So earlier you mentioned you looked at the original Complaint; right?

A. Yes.

Q. Besides your analysis of the original Complaint, did you ever analyze the coupled inductors that are accused of infringement in this lawsuit?

A. I had analyzed the coupled inductors involved in this lawsuit after --

A. I believe so.
Q. Was it your idea or your general counsel's idea to update the opinion letter?
A. I had a discussion. And I think it was a mutual agreement that we should update it.
Q. Why did you come to that agreement?
A. To reflect the filing of the five IPRs and to reiterate our reliance on the opinion -- the January 7th, 2019, opinion.
So we need -- we felt we needed an update to reflect what had happened since the January 17th, 2019, [sic] opinion.
Q. Do you recall earlier when we discussed how you planned to rely on the original invalidity letter to impact willfulness and infringement claims?
A. Yes.
Q. Did you intend to rely on your updated opinion letter for those same purposes?
A. Yes.

Q. Did you intend to rely on your updated opinion letter for any other purposes?

A. Than any other purposes of what? Can you --

Q. Well, other than willfulness and infringement.

A. Infringement and also indirect infringement. Right?

Q. When you updated your invalidity opinion letter, did you consider creating a noninfringement opinion letter?

A. Well, our outside -- at the time, our outside counsel had already determined and concluded noninfringement in -- for at least the reasons cited in the -- excuse me. I'm stumbling because it's after lunch -- in the Interrogatories 14 for infringement. So I deemed it being not necessary.

Q. What Interrogatory 14 are you referring to?

A. To our answers for the reasons -- for our answers to Interrogatory 14 for noninfringement.

Q. Based on your recollection, Interrogatory 14 asked MPS why it believes it does not infringe. And MPS responded with its reasons in response to that interrogatory?

A. That is what I believe of what our outside attorneys had responded with.

Q. Was there any other reason you decided not to create any noninfringement opinion letter?

A. Well, basically, you know, we had hired outside attorneys to defend MPS --

MR. LAVENUE: Just be careful not to disclose attorney-client communications.

THE DEPONENT: Okay. Sure.

A. Yeah, I believe this may be privileged.

BY MR. PIROUZNIA:

Q. At the end of your letter, you conclude that your original analysis and the IPRs are fully consistent; right?

A. Yes.

Q. How did you come to that conclusion?

EXHIBITS 14-15

REDACTED IN THEIR ENTIRETY

Exhibit 16

Deposition of:

Rizwan Khalid

August 23, 2021

In the Matter of:

Volterra Semiconductor LLC v. Monolithic Power Systems, Inc.

Veritext Legal Solutions
800-734-5292 | calendar-dmv@veritext.com |

work with who?

MR. JONES: Coupled conductors.

Q. What about when you were working in test management?

A. Didn't directly work with them, no. I'm sure when we acquired Volterra there were presentations or E-mails, but probably just went from one ear to another because I was focused on test engineering at that time.

Q. So, actually, let's touch on Volterra. Do you work for Volterra or do you work for Maxim?

A. Sorry. What do you mean? Right now?

Q. Yes.

A. Of course, Maxim.

Q. Have you ever worked for Volterra?

A. No.

MR. JONES: I know that we have the tech on. I'm going to see if I can mark this myself.

MR. BARKAN: Forrest, do you want him to open the package?

MR. JONES: Yes, you can go ahead.

(Pause in proceedings.)

THE WITNESS: Do you want me to open to a certain page?

MR. JONES: Yes. We are going to be going to

what's marked as Tab 11 in the binder.

MR. BARKAN: And at this point I'll designate the transcript as "Confidential" under the protective order. The specific designation is "Restricted, Attorney's Eyes Only."

MR. JONES: I guess just to make sure, did the marking of the exhibit as Exhibit 1 go through?

VERITEXT CONCIERGE: Introducing that now and adding the stamp.

(Deposition Exhibit 1 was marked for identification.)

VERITEXT CONCIERGE: This exhibit has been introduced.

BY MR. JONES:

Q. So if you could, just take a moment to look at this document. I'll note for the record that it bears on the bottom right corner a Bates number of MAXIM_00013677.

And when you've finished, let me know.

THE WITNESS: I didn't read all of it, but if you wanted me to I can.

BY MR. JONES:

Q. I think we can start with just asking from sort of your review of it, do you recognize this document?

A. Yes.
Q. What is this document?
A. It was a list of all the patents that was provided to me by our magnetics expert that I copy/pasted into an E-mail to Ahmed.
Ahmed -- I don't remember if he was working in video or intel because I sent the same E-mail in both -- both ways. I just don't remember which way this went. Either video or intel.
Q. So you sent this same E-mail to him at both locations?
A. Yes. He asked for it.
Q. So let's first -- let me make sure that the Realtime is going.
I'd like to first ask, you just said that this list was provided to you by your magnetics expert. Who is your magnetics expert?
THE WITNESS: David, can I answer that question?
MR. BARKAN: Yes, you can answer.
THE WITNESS: Okay. Alex. Alexander, A-l-e-x-a-n-d-e-r.
BY MR. JONES:
Q. And what would be his surname?
A. I don't know how to pronounce it. Ikneroff.

Q. Okay. Ikernoficov. Who is Alexander Ikernicof?

A. He is -- his title is, I think -- let's see here. I think it's distinguished engineer in the magnetics team. Distinguished engineer. So (inaudible) technically.

REPORTER MARTIN: I'm sorry. He cut out. Am I the only one getting that?

MR. BARKAN: He sounds fine to me. I'm not sure what's going on.

REPORTER MARTIN: Can you repeat your answer, please.

THE WITNESS: Yes. So he is a distinguished engineer. He is in charge of all the coupling inductor within Maxim.

REPORTER MARTIN: He's in charge of what designs?

THE WITNESS: Coupled inductor.

BY MR. JONES:

Q. When you say you got this list from him, do you know if he drafted this list or if he got it from another document?

A. I don't know.

Q. What prompted you to ask for this list?

A. At Nvdia, when I met Ahmed, that was his

first job. That was the first time I met Ahmed was at Nvdia, he mentioned about a couple of inductors, and he mentioned that we don't -- he doesn't see like we are protected on our coupled inductors based on his knowledge from our other vendors. And that's what prompted me to send him this list seeing if we are protected.

Q. When was this conversation with Ahmed?

A. I don't -- it has been a while. I mean I had a conversation with Ahmed and then Nvdia and then Intel. So sometime between 2017 and 2019 in two different companies. So I don't remember if this is 11-12-2018 that is shown here is to Intel or Nvdia. If you guys can confirm that, we can probably get the date correctly.

Q. Well, I'll note that this document was produced from Maxim. So to the extent that there's metadata on what E-mail address that's actually sent to, I think that that's something that your side is going to be able to confirm.

A. Okay.

Q. Was this conversation that you were talking about between you and Ahmed, were you the only two involved in that conversation?

A. I do not remember how many other Maxim people

were there, but we were in a meeting room in Nvdia. Me and Ahmed.

Q. It was only Ahmed from Nvdia?

A. From Nvdia --

REPORTER MARTIN: I'm sorry. I don't know why it keeps breaking up. Can you repeat that answer one more time, please.

(A discussion was held.)

THE VIDEOGRAPHER: We are off the record. The time is 1:00 p.m.

(A recess was taken from 10:00 a.m. to 10:02 a.m.)

THE VIDEOGRAPHER: We are back on the record. The time is 10:02 a.m.

MR. JONES: Hopefully, we got the technical issues worked out.

Q. Before the break, we were talking a little bit about the meeting with Nvdia where you said that Ahmed mentioned that another party had indicated that you were not fully protected for coupled inductors?

A. Correct.

Q. Did Ahmed say who this other party was?

A. No.

Q. Do you know who this other party was?

A. At that time?

Q. At that time or now.
A. 100 percent I know who this is. It was MPS.
Q. At that time, did you know it was MPS?
A. No.
Q. At that time, did you suspect it was MPS?
A. Not at that exact timing. The first time I met Nvdia, no. The first time we had this discussion, no.
Q. Was there a time between that first discussion and now at which you suspected that it was MPS?
A. Yes. That was confirmed when one of my customers -- I'm sure you have that in record -- one of our customers from Intel messaged me saying, "MPS is saying coupled inductors are not valid by Maxim, or not valid anymore." And there was a text between me and this engineer at Intel, Tammie Bard.
Q. We'll get to that.
After Ahmed mentioned this during this in-person meeting at Nvdia, why did you send this E-mail? Why was the decision made to send this E-mail?
A. So I told him that we have patents and -- in the meeting I told him we have patents, and they do cover coupled inductor. So he told me to send me the

list in the meeting. So then I went back, talked to Alex, who we have discussed about, and asked him to send me the list, and then I sent it to you guys -- sent it to Allen at Nvdia.

Q. So when you say you told him that you had patents that do cover coupled inductors -- that's a little bit of a tongue twister -- what did you understand that coverage to be?

MR. BARKAN: Objection. Vague. Calls for a legal conclusion.

THE WITNESS: I still have to answer I'm assuming?

MR. JONES: Yes.

MR. BARKAN: Yes.

THE WITNESS: Sorry. Can you just repeat the question?

BY MR. JONES:

Q. Sure. Not asking as a lawyer, but just you in that conversation --

A. Uh-huh.

Q. -- when you said that you had -- that Maxim had patents covering coupled inductors --

A. Yeah.

Q. -- what did you understand that coverage to be?

A. My understanding is that any solution that is using the power converters, along with coupled inductors is patented by Maxim and can only be used by Maxim solution, Maxim control power solution.

Q. And what did you base that understanding on?

A. Internal discussions with our teams. We knew from a while that coupled inductor provides us a lot of value and advantages that our competitors don't, and it's one of -- you can say one of the key elements, advantages that Maxim has.

Q. I think I asked a slightly different question than the one that you answered.

A. Please answer again.

Q. Sure. You mentioned in your answer advantages of coupled inductors, but my question is more about the coverage for coupled inductors, what the basis is for thinking, as you say, that any power converter with a coupled inductor is covered.

A. Based on our internal discussions. I obviously didn't read all the patents.

Q. Internal discussions with who?

A. With a bunch of people at Maxim, like a lot of internal meetings, just knowing -- I mean obviously Alex being one of them, but just a bunch of meetings like how it's protected and it's Maxim's IP and things

EXHIBITS 17-26

REDACTED IN THEIR ENTIRETY

Exhibit 27

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

VOLTERRA SEMICONDUCTOR, LLC,

Plaintiff,

v.

CASE NO.: 19-02240

MONOLITHIC POWER SYSTEMS, INC.,

Defendant.

RESTRICTED - ATTORNEYS' EYES ONLY

VIDEOTAPED REMOTE DEPOSITION OF

JOSHUA WILLIAM PHINNEY

Friday, October 22, 2021

9:05 a.m. Eastern Daylight Time

Reported by:

GRETA H. DUCKETT, CCR, RPR, CRR, CVR-S, RVR-M-S

JOB NO.: 3426

different sense. But another thing that you do is you switch how the terminals are connected between the windings. And so, you know, there's this way that the sense of the windings and how it's wound and the sign of the current sort of interact, and they can sort of cancel out one another.

So if you change one and change the other also, you can still be oriented in like direction. So what's really important to look at is which direction the flux is going, because the flux sort of accounts for the fact that you can change -- you can change its direction, the flux's direction, through either a change in current or a change in how you wind the winding.

Q. Do both Figure 3A and Figure 3B show the windings wound in like orientation?

A. Yeah. I think that's true in the -- the way the patent describes it at this point is trying to elucidate what "winding in like direction" means. And even though these Figure 3A and 3B differ in the sense of one of the windings and so forth -- they differ in little ways -- they're both still oriented in

like direction, because they've been wound such that the flux has that -- the opposite directions.

Q. And the flux has the opposite directions when the current passes from Vx1 and Vx2 to Vc, correct?

A. Yeah. It will do it for that condition. I think it will even do it if it's coming from the load 2. I think you'll still have the condition where the flux will collide. It will, perhaps, just go the other way if the current is reversed.

Q. So you're saying if we go from Vc to both Vx1 and Vx2, we'll still collide in the opposite direction, right?

A. I think that's right. If you don't mind me holding up my hand and just looking. Yeah, that's right.

Q. What if our current goes from Vx1 to Vx2?

A. So there's no load -- no load current on Vout?

Q. Right.

A. In that case, unless I'm mistaken -- I haven't considered this until you

asked. But if I'm not mistaken, the flux in both windings will go in the same direction. The structure will generate a high impedance to that current. That's effectively a differential mode current. Because by the terms of your question, we've made the current into one winding, like into the terminal Vx1 is equal and opposite with the current in Vx2. So the current I put into Vx2 comes out of the -- the current I put into Vx1 comes out of Vx2.

That is a differential mode current. And that will -- that's what the structure is designed to impede. It will generate a large impedance because that will link flux into the core. That will no longer have the property of, you know, of -- of because of symmetric excitation, forcing the flux to not go through the mutual pathway, but return through the leakage pathways.

Q. If the current went from Vx1 to Vx2, you said that the fluxes would then both be going in the same direction around the core, right?

A. Yeah. I think that's right because you're -- if I'm understanding your question

right, you're saying that the current I put into Vx1 will be the current that comes out of Vx2.

Q. And if the current you put into Vx1 came out of Vx2, would this inductor in Figure 3A still be in like orientation?

A. I haven't considered that, but I think, yes, it would. And that's why it would act as a differential mode choke. That's why -- because it was oriented in like direction, that's why it would generate a large impedance in response to that differential mode current.

Q. And it's desirable to have the inductor act as a differential mode choke for this particular application, right?

A. I think, for interleaved converters, it can be a great idea. This is -- you know, this is a -- something that's clear from Wong Investigating, for instance, because by alternatively activating the windings and interleaving the windings, you're creating already kind of a differential excitation. You have some parts of the excitation where the current in one winding is doing one thing and

the current in the other winding is going the opposite direction.

You're introducing a lot of differential excitation by interleaving. So this kind of structure is helpful in that regard because it generates impedance for the -- to the differential mode component of the AC current.

Q. If we flip to Figure 1, does this also show windings wound in a like orientation?

MR. RAVULA: Objection.

Vague.

A. I'd say it does. And this is one of the figures that the patent uses to explain what "like orientation" means.

Q. Does -- let me ask you a different question.

Let's go back to your opening report and go to paragraph 51, where you talk about the claim constructions in this case. That's on page 12. Let me know when you're there.

A. I'm there.

Q. And you reviewed the parties' claim construction briefing in this case, right?

EXHIBITS 28-32

REDACTED IN THEIR ENTIRETY

Exhibit 33

GIBBONS

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May 27, 2021

PRIVILEGED AND CONFIDENTIAL
ATTORNEY-CLIENT COMMUNICATION
AND ATTORNEY WORK PRODUCT

VIA ELECTRONIC MAIL

Roland Tso, Esq.
Monolithic Power Systems, Inc.
79 Great Oaks Blvd.
San Jose, California 95119

Re: Invalidity Opinion Regarding U.S. Patent No. 7,772,955

Dear Mr. Tso:

In response to your request, we have undertaken for Monolithic Power Systems, Inc. ("MPS"), a limited study of the validity, or lack thereof, of claims 1-3, 5, 10, 12-21 and 23-28 ("Studied Claims") of U.S. Patent No. 7,772,955 ("`955 Patent"), which is attached as Exhibit 1. We have not studied, nor render any opinion regarding the validity of any other claim of this patent. The records of the USPTO, Assignment Branch, indicate that the patent is owned by Volterra Semiconductor LLC as of the date of this letter.[1]

Our analysis of the Studied Claims was limited to potential issues arising under 35 USC §§ 102 and 103, that would render any or all the studied claims invalid. With regard to this analysis of the Studied Claims, we limited our analysis to only those prior art references identified in the Inter Parties Review Petition filed by MPS in the USPTO, Patent Trial and Appeal Board ("PTAB"), namely IPR2020-01351 (the "IPR Petition").

We acknowledge that MPS filed a second petition for IPR, namely IPR2020-01350, against `955 Patent claims that we were not requested to analyze for our invalidity study. Because in our opinion, the prior art cited in MPS's IPR petition for IPR2020-01351, invalidates the Studied Claims, we did not review, nor provide any opinions concerning the different prior

[1] The ownership of `408 Patent is based on the USPTO records showing that U.S. Patent Application No. 10/318,896, the parent application to the divisional application that resulted in the `955 Patent, is owned by Volterra Semiconductor LLC as of the date of this letter.

Exhibit 34

GIBBONS

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May 27, 2021

PRIVILEGED AND CONFIDENTIAL
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AND ATTORNEY WORK PRODUCT

VIA ELECTRONIC MAIL

Roland Tso, Esq.
Monolithic Power Systems, Inc.
79 Great Oaks Blvd.
San Jose, California 95119

Re: Invalidity Opinion Regarding U.S. Patent No. 7,525,408

Dear Mr. Tso:

In response to your request, we have undertaken for Monolithic Power Systems, Inc. ("MPS"), a limited study of the validity, or lack thereof, of independent claim 14 and its dependent claim 20 ("Studied Claims") of U.S. Patent No. 7,525,408 ("'408 Patent"), which is attached as Exhibit 1. We have not studied, nor render any opinion regarding the validity of any other claim of this patent. The records of the USPTO, Assignment Branch, indicate that the patent is owned by Volterra Semiconductor LLC as of the date of this letter[1].

Our analysis of the Studied Claims was limited to potential issues arising under 35 USC §§ 102 and 103, that would render any or all the studied claims invalid. With regard to this analysis of the Studied Claims, we limited our analysis to only those prior art prior art references identified in the Inter Parties Review Petition filed by MPS in the USPTO, Patent Trial and Appeal Board ("PTAB"), namely IPR2020-01348.

For the reasons explained in the following sections, it is our opinion that a court of competent jurisdiction would find:

a) Claim 14 is invalid as anticipated under 35 USC § 102 and/or obvious under 35 USC § 103 based on *Shultz* (defined below and attached as Exhibit 2).

---

1 The ownership of '408 Patent is based on the USPTO records showing that U.S. Patent Application No. 10/318,896, the parent application to the divisional application that resulted in the '408 Patent, is owned by Volterra Semiconductor LLC as of the date of this letter.

Exhibit 35

GIBBONS

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May 27, 2021

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AND ATTORNEY WORK PRODUCT

VIA ELECTRONIC MAIL

Roland Tso, Esq.
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79 Great Oaks Blvd.
San Jose, California 95119

Re: Invalidity Opinion Regarding U.S. Patent No. 6,362,986

Dear Mr. Tso:

In response to your request, we have undertaken for Monolithic Power Systems, Inc. ("MPS"), a limited study of the validity, or lack thereof, of independent claim 17 and its dependent claims 18, 20, 21 and 23 ("Studied Claims") of U.S. Patent No. 6,362,986 ("'986 Patent"), which is attached as Exhibit 1. We have not studied, nor render any opinion regarding the validity of any other claim of this patent. The records of the USPTO, Assignment Branch, indicate that the patent is owned by Volterra Semiconductor LLC as of the date of this letter.

Our analysis of the Studied Claims was limited to potential issues arising under 35 USC §§ 102, 103 and 112, that would render any or all the studied claims invalid. With regard to our invalidity analysis of the Studied Claims in view of prior art under 35 USC §§ 102 and 103, we limited our analysis to only those prior art prior art references identified in the Inter Parties Review Petitions filed by MPS in the USPTO, Patent Trial and Appeal Board ("PTAB"), namely IPR2020-01368 and IPR2020-01370.

For the reasons explained in the following sections, it is our opinion that a court of competent jurisdiction would find the Studied Claims:

a) Invalid as indefinite under 35 USC § 112,

b) Invalid as obvious under 35 USC § 103 based on *Pietkiewicz* (defined below and attached as Exhibit 2), and